

CLAYTONIA PALUSTRIS (PORTULACACEAE),
A NEW SPECIES FROM CALIFORNIA

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ABSTRACT

A new species of *Claytonia* (Portulacaceae) is described from the Sierra Nevada of California. Morphology, chromosome number, and distribution indicate a close relationship with *C. sibirica*.

Montia heterophylla (Torr. & Gray) Jepson was transferred to *Claytonia* by Swanson (1966) in his assessment of systematic relationships in the Montioideae (Portulacaceae). Jepson (1914) had indicated that the combination was based on *C. unalaschkensis* β *heterophylla* Nuttall. This was a manuscript name published by Torrey and Gray (1838) as a synonym of *C. alsinoides* γ *heterophylla* Torr. & Gray. Examination of the type of *heterophylla* (Nuttall s.n., "Oregon", NY!), shows it belongs to *C. sibirica* L., and differs from California collections upon which Jepson, Swanson, and others have based their usage of this epithet. The two collections cited by Jepson (Jepson 4884, JEPS; Hall and Chandler 304, UC) are stoloniferous, whereas the Nuttall specimen is not. Our further studies of the California plants, which in the past have been referred to *C. (Montia) heterophylla*, show that they represent a distinct species. This new species is differentiated easily from *C. sibirica* and from members of *Claytonia* sect. *Rhizomatosae* (*C. cordifolia* S. Watson, *C. nevadensis* S. Watson, *C. sarmentosa* C. A. Meyer, and *C. scammaniana* E. Hulten).

***Claytonia palustris* Swanson and Kelley, sp. nov.**

Herbae perennes, glabrae. Caules simplices, ca. 10–20 cm alti. Radix verticalis, stolones ex axillis foliorum producents. Folia caulesque virides; radix stolonesque albid. Inflorescentia terminalis, racemosa, floribus in axillis bractearum, numerosis. Ovarium postremo uniloculare, ovulis 3 (Fig. 1).

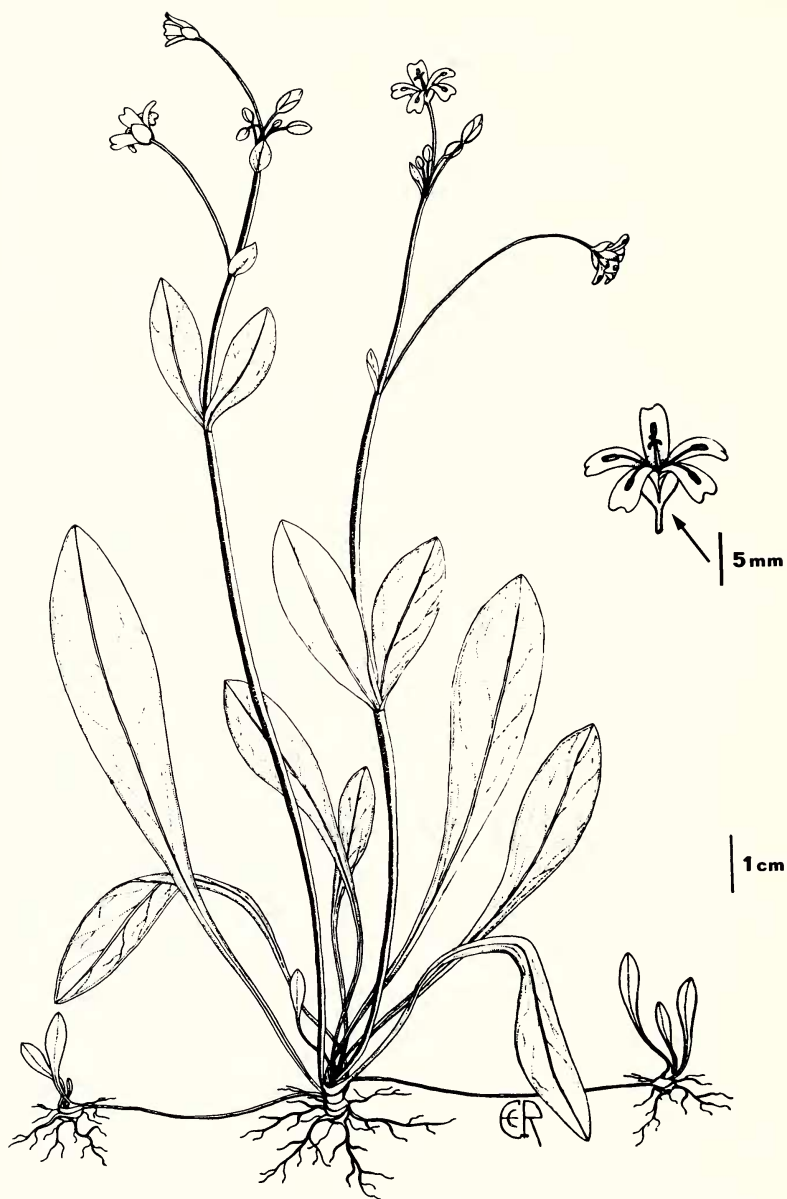


FIG. 1. *Claytonia palustris*. Drawn from Swanson 490.

Perennial glabrous herbs with white fleshy rootstalks 2–3 mm wide, 4–15 mm long. Stolons white, terete, 1–2 mm in diameter, 5–15 cm long, arising from the axils of the basal leaves. Basal leaves 1–10, lamina oblanceolate 3–4 cm long, 1–1.5 cm wide, petioles 5–10 cm long. Flowering branches several, 10–20 cm long; inflorescence terminal, racemose, 5–10 cm long, subtended by a pair of opposite, subsessile, slightly unequal, oblanceolate to narrowly elliptic leaves 0.5–1.5 cm wide, 2–5 cm long, sessile or tapering into a winged petiole. Flowers 5–12, each subtended by a sessile, ovate to elliptic bract, 1–3 mm wide, 3–8 mm long; sepals 2, 1–3 mm wide, 3–4 mm long; petals 5, oblong, white, emarginate, 5–9 mm long; stamens 5, opposite the petals, filaments 4–7 mm long, pollen 3-colpate; ovary unilocular at maturity, 2-valved, ovoid, 2–3 mm long; 1.5–2.5 mm wide; ovules 3; styles 3–5 mm long, style branches 3, each branch only partially stigmatic. Seeds 3, glossy, black. Chromosome number $n = 6$.

TYPE: USA, CA, Butte Co.: Jonesville, marshy, sloping, spring-fed meadow above s. bank of Jones Creek, 0.4 km e. of the Jonesville Hotel, 1550 m, 4 Jul 1959, *Swanson 490*, (Holotype: OSC; isotypes: CAS, CS, Mesa College, RSA, NY, SFV, UC).

PARATYPES: CA, Plumas Co.: Lake Almanor, 18 Jun 1920, *Clements s.n.* (CAS); Butterfly Valley, 23 Jun 1967, *Howell 42704* (CAS, OSU). Butte Co.: Chico Meadows, Sierra Nevada, 25 Jun 1915, *Heller 12022* (CAS); Jonesville, s. bank of Jones Creek, 0.4 km e. of Jonesville Hotel, 13 Jun 1959, *Swanson 477* (SFV). Fresno Co.: Pine Ridge, 15–25 Jun 1900, *Hall and Chandler 304* (UC); Frying Pan Meadow, s. fork of Kings' River, 12 Jul 1940, *Munz 15960* (RSA, UC). Tulare Co.: Sequoia National Park, vicinity of Alta Peak, 4 Aug 1896, *Dudley 1568* (DS); Jordan Hot Sprs., 18 Jul 1906, *Hall and Hall 8392* (UC); Cliff Creek, near junction of Timber Gap and Black Rock Pass trails, 31 Jul 1943, *Ferris and Lorraine 10944* (UC); Tule River, Sierra Nevada, *Pierson 1860* (RSA); Crescent Meadow, Sequoia National Park, 17 Jun 1956, *Tillett 464* (RSA); s. fork of middle fork of Tule River, 6 Jun 1974, *Gordon et al. 255* (SFV).

Claytonia palustris is characterized by a fleshy perennial stem 2–3 mm in diameter from which basal rosette leaves, stolons, scapose inflorescence branches, and adventitious roots arise. A distinctive feature of the species is the unequal length of the two opposite leaves that subtend the inflorescence, a phenomenon not found in any other *Claytonia* species.

Distribution and ecology. *Claytonia palustris* is endemic to California. It is known from two disjunct regions at opposite ends of the Sierra Nevada (Fig. 2) and from a third disjunct region in Siskiyou Co. (see Miller et al. 1984, Fig. 4). The species is largely restricted

to sunny areas, in wet meadows, marshy slopes, and streamside vegetation at mid elevations (1025–1650 m) in the north, and to mid and high elevations (1550–2450 m) in the south. Throughout most of its range, *C. palustris* does not overlap with the known distribution of *C. sibirica* s.l., the taxon with which it was confused by Jepson (1914) when he described the distribution of *M. heterophylla* as “Southern Sierra Nevada, 5700–7000 feet. Oregon to Alaska.” The Nuttall type locality, “Columbia Woods”, is within the range of *C. sibirica*, which is widespread in the northwestern United States, coastal British Columbia, Alaska, and the Aleutian and Commander Islands. Members of the *C. sibirica* complex extend southward into the California coast ranges to Santa Cruz Co., and eastward to Siskiyou Co. in the northern part of the state, where the complex overlaps the range of *C. palustris*.

The habitats in which *C. sibirica* s.l. is found in California and Oregon are moist but not marshy. *Claytonia sibirica* is adapted to growing in shaded habitats, whereas *C. palustris* is not. Many of the habitats occupied by *C. sibirica* are disturbed by natural causes or by man and it often grows as a ruderal plant. In Great Britain where *C. sibirica* was introduced in the last century, it has become widespread and is considered a weed (Salisbury 1961). Ruderal tendencies are not apparent in any of the populations of *C. palustris*.

The distribution of *C. nevadensis* approximates that of *C. palustris* (Fig. 2), although the individual populations are isolated geographically and ecologically. At similar latitudes, *Claytonia nevadensis* is found at higher elevations than *C. palustris*. The former is restricted to relatively pure stands, whereas *C. palustris* is found embedded in a dense tangle of perennial vegetation.

Claytonia cordifolia is widespread in the pacific northwest and extends southward into Siskiyou Co., California. Ecologically this species is similar to *C. sibirica* in its capacity to grow in shaded habitats, and to *C. palustris* in its ability to withstand competition from other vegetation. *Claytonia cordifolia* also is generally found in marshy or very moist situations.

Variation. Field and herbarium studies indicate that species of sect. *Rhizomatosae* are relatively uniform throughout their range. Chambers (1963) also noted the uniformity of *C. nevadensis* populations. *Claytonia sibirica*, however, is quite variable within and between populations. Miller et al. (1984) demonstrate that a euploid series exists in the taxon. The five species of sect. *Rhizomatosae* rely largely upon asexual reproduction by the use of branching rhizomes or stolons. Asexual reproduction is an adaptation common in plants living in climatically severe environments or where seedling establishment is difficult due to competition in closed communities (Stebbins 1950).

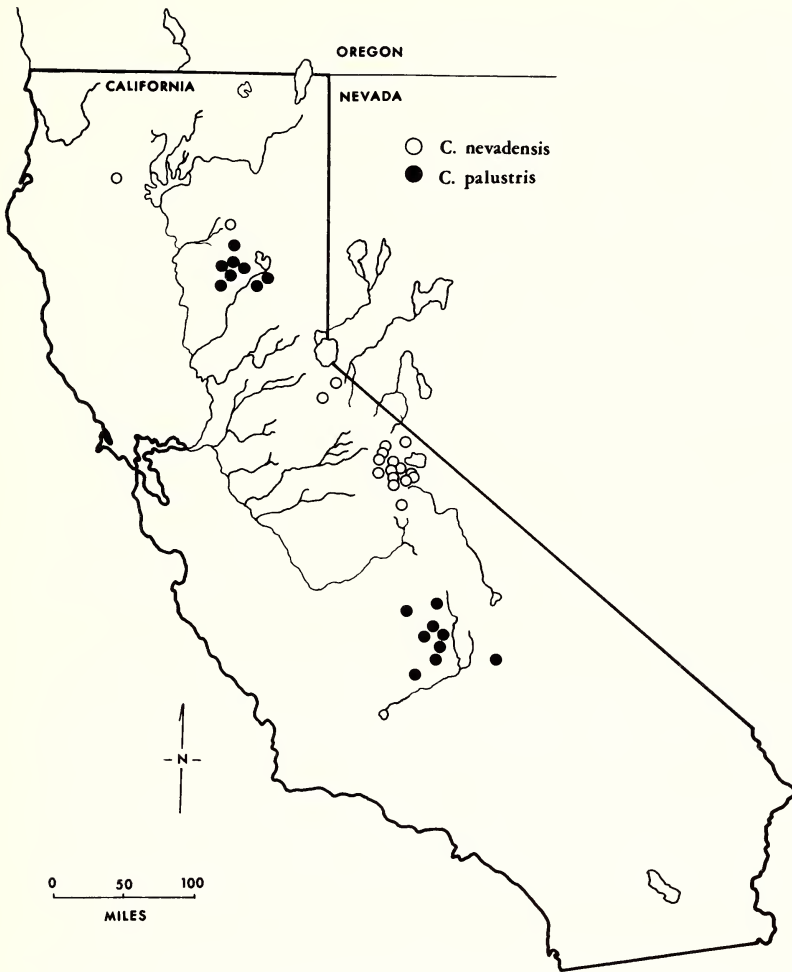


FIG. 2. Known localities for *Claytonia nevadensis* and *C. palustris*.

Chromosome counts. Previously unreported chromosome counts are given here; vouchers are deposited at SFV. Four collections of *C. palustris* (Butte Co., Swanson 477, 490; Plumas Co., Swanson 1047; Tulare Co., Swanson 1162) are all $n = 6$. Three populations of *C. nevadensis* are $n = 7$ (Lassen Co., Swanson 509; Mono Co., Swanson 1055, 1056). Counts were performed on three plants from each collection. All counts were made from anthers fixed in 3:1 ethanol-acetic acid and stored in 70% ethanol at 4°C until used. Meiosis was regular in all microsporocytes examined.

TABLE 1. CHARACTERS USED TO DIFFERENTIATE *C. palustris* AND CLOSELY RELATED SPECIES. See Lewis (1967) and Miller et al. (1984) for references to chromosome numbers not reported in this paper.

Species	Ovule number	Maximum seeds matured	Inflorescence bracts	Chromosome numbers	Runners or stolons
<i>C. cordifolia</i>	6	3	none	$n = 5$, $2n = 10_{II}$, 20_{II}	no
<i>C. nevadensis</i>	6	6	one	$n = 7$, $2n = 14_{II}$	yes
<i>C. palustris</i>	3	3	several	$n = 6$, $2n = 12_{II}$	yes
<i>C. sarmentosa</i>	6	6	none	$n = 7, 8$, $2n = 14_{II}$, 16_{II} , 28_{II} , 32_{II}	yes
<i>C. scammaniana</i>	6	6	none	unknown	unknown
<i>C. sibirica</i>	3	3	several	$n = 6$, $2n = 12_{II}$, 24_{II} , 36_{II}	infrequent

Relationships. In this paper, binomials are used to represent the nominal taxonomic species although different ploidy levels are known to exist within some of them and reproductive isolation is presumed to exist. The principal features we used to separate species of *Claytonia* are: 1) ovule number; 2) seed number; 3) ovule abortion; 4) number of bracts in the inflorescence (e.g., none, one subtending the lowermost flower, or several and each one subtending a flower); 5) base chromosome number; and 6) the presence or absence of stolons (Table 1).

Claytonia palustris shows similarities in these characters with members of sect. *Rhizomatosae* (*C. nevadensis*, *C. sarmentosa*, *C. scammaniana* and *C. cordifolia*) and members of *C. sibirica* s.l. (sect. *Caudicosae*). Jepson (1914, p. 474) referred to *C. palustris* accurately when he wrote (of *M. heterophylla*), "Stems . . . rising from tuberous rootstocks or cormlets, these sending out slender stolons that produce terminal cormlets, the secondary cormlets promptly producing leaves and flowers . . ." In these respects, *C. palustris* most closely resembles *C. nevadensis* and occasional plants of *C. sibirica*. Morphologically, there are greater differences between these species and *C. cordifolia* (Table 1). Our data suggest the close relationship of *C. palustris* and *C. sibirica*. In addition, similarities in flower size and morphology, leaf shape, leaf and stem texture, and plant and flower color support this suggested relationship. The occasional formation of stolons by *C. sibirica* (Swanson 1966) is quite similar to that in

C. palustris. The same base number ($n = 7$), six-ovuled flowers, pigmentation of vegetative parts and flowers, and texture of leaves suggest the affinity of *C. nevadensis* and *C. sarmentosa* and possibly *C. scammaniana* (chromosome number unknown). *Claytonia cordifolia* is isolated in sect. *Rhizomatosae* on the basis of chromosome number ($n = 5$). The regular abortion of three of the six ovules produced by each flower of *C. cordifolia* is an example of an evolutionary phenomenon that may have occurred independently in at least three groups in the genus (i.e., *C. sibirica*, *C. perfoliata* Donn ex Willd., and *C. spathulata* Dougl. ex Hook. species complexes).

Chambers (1963) has noted a number of anatomical differences between *C. cordifolia* and *C. nevadensis*. Further anatomical and morphological studies of *C. sibirica* s.l., *C. palustris*, and members of sect. *Rhizomatosae* are necessary before the relationship and taxonomy of these species can be clarified.

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LITERATURE CITED

- CHAMBERS, K. L. 1963. *Claytonia nevadensis* in Oregon. Leaflet W. Bot. 10:1-8.
- HULTEN, E. 1968. Flora of Alaska and neighboring territories. Stanford Univ. Press, Stanford.
- JEPSON, W. L. 1914. Portulacaceae. In W. L. Jepson, A flora of California. Part 5, p. 465-480. Univ. California, Berkeley.
- LEWIS, W. J. 1967. Cytocatalytic evolution in plants. Bot. Rev. 33:105-115.
- MILLER, J. M., K. L. CHAMBERS, and C. E. FELLOWS. 1984. Cytogeographic patterns and relationships in the *Claytonia sibirica* complex (Portulacaceae). Syst. Bot. 9: 266-271.
- SALISBURY, E. J. 1961. Weeds and aliens. Collins, London.
- STEBBINS, G. L. 1950. Variation and evolution in plants. Columbia Univ. Press, New York.
- SWANSON, J. R. 1966. A synopsis of relationships in Montioideae (Portulacaceae). Brittonia 18:229-241.
- TORREY, J. and A. GRAY. 1838. A flora of North America. 1:198-202. New York.

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